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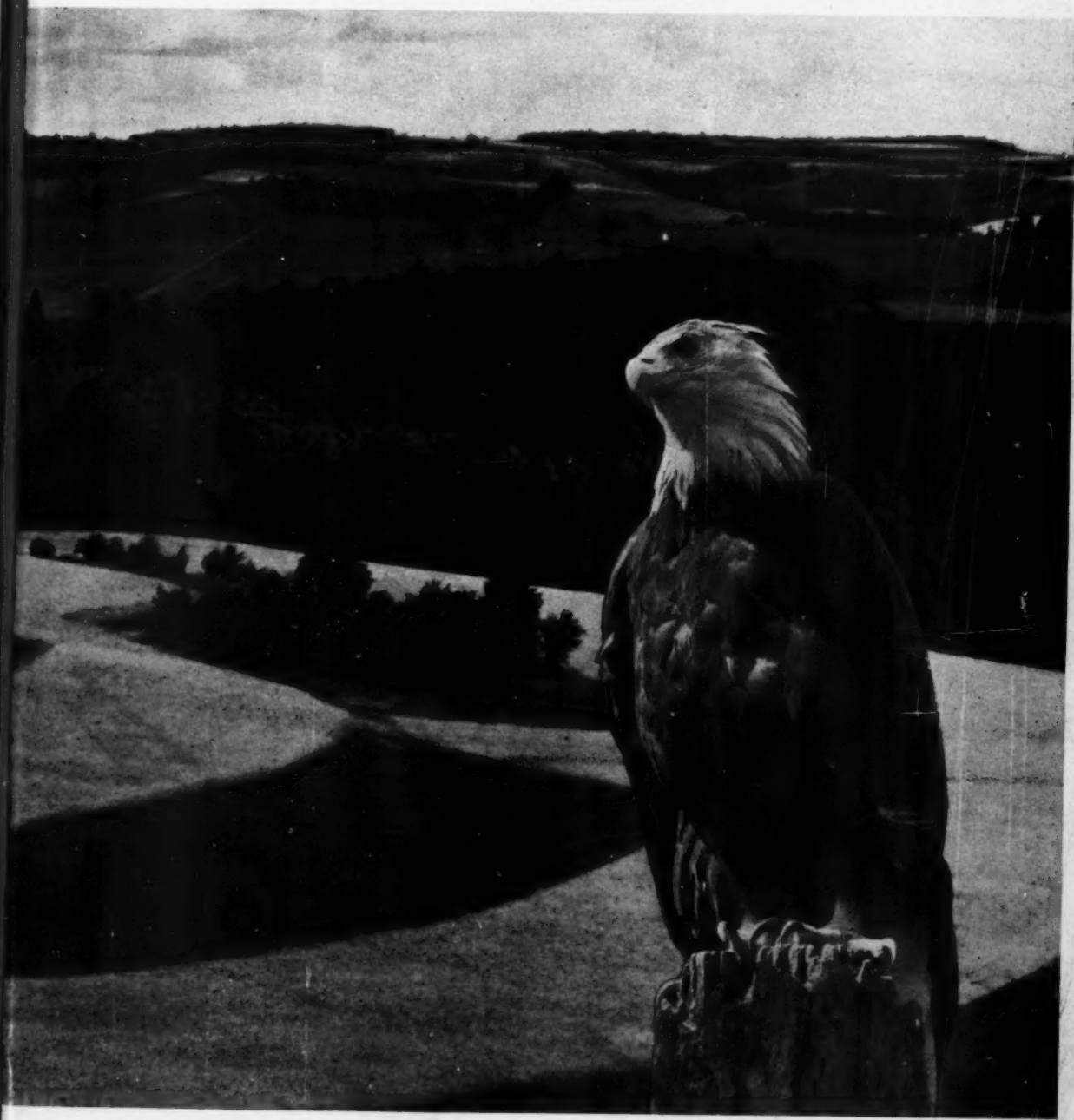
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SOIL CONSERVATION

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JUNE 1944

SOIL CONSERVATION

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Front cover: A proud bird and a proud new agriculture! By combining two photographs, a result is achieved which symbolizes the determination of the Nation to defend the American land from the destroying forces of man and nature.

SOIL CONSERVATION is issued monthly by SOIL CONSERVATION SERVICE of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business, with the approval of the Director of the Budget. SOIL CONSERVATION seeks to supply to workers of the Department of Agriculture engaged in soil conservation activities, information of special help to them in the performance of their duties. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., 10 cents a copy, or by subscription at the rate of \$1.00 per year, domestic; \$1.50 per year, foreign. Postage stamps will not be accepted in payment.

Range Conservation Pays Dividends



By ROBERT V. BOYLE

H. F. Prewitt, of Coolidge, N. Mex., has more than doubled grazing capacity, and made a reputation for range improvement. Prewitt's story, like that of many another successful stockman, is properly prefaced by some background information. His accomplishments, as a matter of fact, have come largely as a result of his own good understanding of the conditions which govern range use.

A typical southwestern ranch consists of uplands (mountains, hills, ridges, mesas) and bottom lands (alluvial valleys or floor plains). All the moisture that the uplands get is what rain falls on them—usually 7 to 16 inches a year. Bottom lands that haven't been gullied and drained, on the other hand, receive many times this amount of water because of run-off from above. They are, in effect, irrigated with each flood. It is not unreasonable to state that good native bottom lands can carry 10 to 15 times the number of livestock that a similar acreage of uplands can support. But many valleys are cut with gullies, and for that reason they "aren't what they used to be." Getting floodwaters back on the flat where they belong isn't easy. It isn't even practicable in some instances because the valley may be too far gone



H. F. Prewitt, stockman of Coolidge, N. Mex., who has more than doubled the grazing capacity of his ranch through soil conservation practices.

or because the arroyo is too big and carries too much water to tamper with. There are many other valleys, however, that are subject to restoration by means of water-spreading.

In 1938, Prewitt, out of his own experience and what he had been hearing, decided that his bottom lands were not holding up their end of the range load. At that time, the Breece-Prewitt Sheep Co.,

EDITOR'S NOTE.—The author is chief, operations division, Soil Conservation Service, Albuquerque, N. Mex.

in which Prewitt was a major stockholder, operated on something like a half-million acres. The area on which the company desired to try out range conservation "treatment" was near the headquarters on the north side of the Zuni Mountains. Prewitt solicited the assistance of the Soil Conservation Service. The 13,000 acres to be treated constituted a complete watershed. It covered the very head of the Rio Puerco of the West, a tributary to the Little Colorado. A highway and a railroad, both transcontinental, traversed the area. By January 1939 Prewitt and the Service had worked out a mutually satisfactory plan.

On the uplands, it was contemplated to provide a small amount of fence removal and fence construction, four stock tanks, to reseed 130 acres, to plant trees, and shrub in gullies and arroyos, to employ contour furrowing where adapted, to use brush spreaders above gully head cuts, to install road water bars and a few rock and brush gully checks.

On the bottom lands, comprising 1,178 acres, the plan included four diversion dams, main diversion and lateral ditches, protection dikes, contour dikes, masonry ditch structures, wooden turn-out boxes, contour furrowing, fencing, tree planting in washes and gullies, seeding of pasture grasses and legumes.

It was anticipated that the flood plains would produce much more forage than they had been producing in recent years, so the estimated rate of future stocking was set at 2,800 animal-unit months for the range unit, including both bottom land and upland.

It is well to repeat that it was Prewitt's own idea to do all of this. He wanted to lighten the range load on his uplands where there had been local concentration of stock. He wanted to bring back his bottom lands. Most important of all, he realized that water spreading was the equivalent of irrigation. He knew that irrigation meant installation of structures, labor to manipulate them, and maintenance to keep them serving his needs. He had established water rights. He backed up his judgment with a substantial investment in these improvements. Although at that time Soil Conservation Service had CCC and similar type labor which it used rather freely on demonstrational work, Breece-Prewitt ranch stood over half of the over-all cost.

The work was completed by early 1940, and the results of water spreading were beginning to show. It so happened that in this year the cooperative agreement became inoperative because of the disbanding of the Breece-Prewitt Sheep Co. Harold Prewitt and his wife, Hazel, retained most of the range, including the unit under discussion. They were no

longer under any obligation to continue the conservation program. Did they drop any phase of it, or merely let matters rest? Far from it! Prewitt was so well sold on the productive possibilities of his flooded lands that he drilled four wells for irrigation. Three of these proved to be flowing wells. He also built a reservoir of 350 acre-feet capacity, with canals and ditches.

Prewitt disclaims being a farmer; but, being resourceful and foreseeing war shortages, he put 80 acres into crops—corn and beans—and 8 other acres into garden. All of this is irrigated.

This is how the home ranch unit shapes up now:

	Acres
Range land.....	12,000
Semi-irrigated pasture.....	450
Semi-irrigated hay-pasture.....	440
Irrigated hay-pasture.....	200
Irrigated cropland (40 to corn).....	80
Irrigated garden.....	8
Total.....	13,178

The range and pasture land is used as follows: 4,500 ewes are lambled in the spring; hay grows up during summer and is cut during August, 700 steers are grazed during late summer and fall, and about 250 yearlings are wintered.

Actual feed production on the basis of animal-unit months (5 sheep=1 cow) is summed up as follows:

	Animal-unit months' feed
4,500 sheep-months' grazing equals.....	900
2,200 cow-months' grazing equals.....	2,200
270 tons hay equals.....	1,000
24 tons corn equals.....	158
Total.....	4,258

Prewitt estimates that, of the above, about 2,100 animal-unit months are represented by range land (uplands). The remainder, or 2,150 animal-unit months' feed, is produced by irrigated and semi-irrigated bottom lands. It is possible to irrigate only 240 acres whenever water application is necessary, ordinarily about three times during the growing season. Another 890 acres are semi-irrigated or floodwater irrigated; that is, they are watered only when the arroyos run. Without the diversion dams and ditches, this water would be going on down to dissipate, chiefly by evaporation, in the wide, sandy beds of the Rio Puerco and the Little Colorado.

The following is a comparison of present use on uplands and bottom lands, respectively: The 12,000 acres of upland range provide 2,100 animal-unit months' feed, or enough for 175 cattle year long. This means 68 acres per cow year long, or $5\frac{2}{3}$ acres per animal-unit month. The 1,130 acres of irrigated and semi-irrigated bottom land provide 2,158 animal-



unit months' feed, or enough for 180 cattle year long. This means 6.3 acres per cow year long, or 0.52 acre per animal-unit month.

What is the production on this 13,000-acre unit of the Prewitt ranch worth in dollars and cents? That is hard to say. It can't easily be evaluated, because the presence or absence of such a spread could mean success or failure for the ranch as a whole. A highly productive range unit like this is the heart of an outfit, the "nursery" for lambing, the "hospital" for thin and crippled stock, the holding pasture for shipping time, and a number of other things. Nevertheless, here's an attempt to set down some gross figures:

1. 1,600 steer-months' grazing in summer and fall. Gain averages 2 pounds (or more) per head per day, which means 96,000 pounds of beef, and at 12 cents has a value of \$11,520.

2. 1,000 steer-months' winter grazing (maintenance), with grass valued at 40 cents per head per month, means a value of \$400.

3. Lambing on the unit has ceased to be a gamble. Because of sure feed, lambing sheds have been built. With the set-up, less labor is required. Counting all sheep, including drys, Prewitt gets a 95-percent lamb crop at marking time. He states that with assurance of these results it is worth \$1 for each ewe turned in the area. Three bands, or 4,500 ewes, are lambed, which would mean \$4,500.

4. 270 tons of hay are produced, which, at \$20 per ton, are worth \$5,400.

5. 857 bushels of corn are harvested, and at \$1.50 per bushel are worth \$1,285.

6. The total of 1 to 5, inclusive, means a gross value of \$23,105 from this improved range unit per year.

This represents an average gross per acre of \$1.75. It is significant that over half of the total is produced by one-twelfth of the land. This emphasizes the relative value of bottom lands. The importance of uplands should not be overlooked, however. Having been treated for erosion in the worst places and being properly stocked, they are not only producing forage to complement that produced in the valleys but they also produce the water needed by the valleys. This water is of good quality and in governable amounts.

Some "before" and "after" figures are worth mentioning. Prior to 1939, Prewitt lambed 3,000 ewes for 1 month, grazed 2,000 ewes in the fall for 15 days, and grazed 200 cattle for 4 months during the summer, a total of 1,600 animal-unit months. In 1939 Prewitt and the Soil Conservation Service range specialist agreed that after the structural work had been completed and after the flooded areas had had opportunity to become established with good forage, the entire unit could probably safely sustain 2,800 animal-unit months' use. The present use being

made of the area, as indicated previously, is 4,258 animal-unit months. Thus, the grazing capacity has increased over two and one-half times in 5 years. This is 52 percent more than it was anticipated the area would carry following development. This is because of Prewitt's persistence in not only maintaining his floodwater irrigation system but also in improving it.

Prewitt states that formerly he could use only half of the "range" portion of this unit, due to poor distribution of water, but that since construction of stock tanks he can reach all portions. Further, he states that the over-all grazing capacity of the upland range has increased one-third because of reseeding of denuded areas, contour furrowing, small brush spreaders, and other practices.

I myself am familiar with the area, and viewed it recently. I noticed considerable unused grama grass even near stock-watering places. Quality and amount of grass, clover, and alfalfa in the bottoms have not reached the top; there continues to be steady improvement. Arroyos and gullies are slowly but surely healing over.

As evidence of good range and good management, it is pointed out that while this ranch has always raised good lambs (average, 74 pounds), it is now raising better ones. Average lamb weights at sale time in 1942 were 82 pounds. In 1943, the lambs averaged 81 pounds. Long yearlings, mixed steers, and heifers go off in the fall at the average of 720 pounds. Full credit for the increased weights, of course, can't be given to this one range unit, since sheep and cattle are on it only a portion of the year. The

entire ranch, however, has been improved by tank construction and other measures.

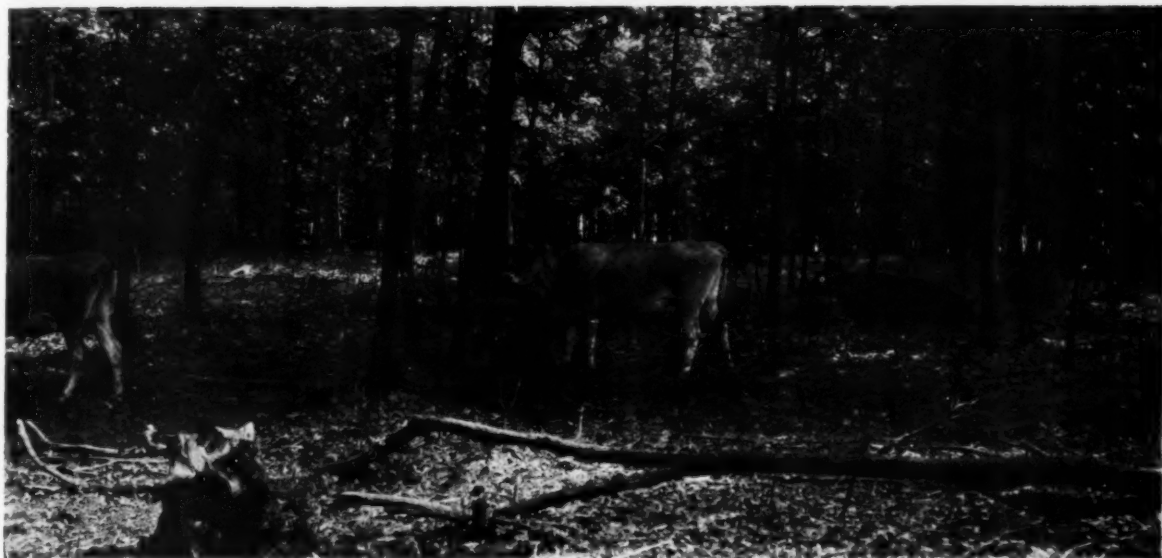
Prewitt still does not feel that he has overinvested on improvements. He is now putting up sheep- and wolf-proof fences around his irrigated and semi-irrigated pasture and hay lands. He is putting in numerous small tanks to be filled from ditches throughout his bottom lands. Also, he continues to plant improved pasture mixtures, grasses, and legumes where there is evidence of need. Mr. and Mrs. Prewitt are shrewd business people, and there is no doubt about these investments paying dividends. There are a number of indexes to economic justification, but it will suffice to cite only one.

As has been said, the grazing capacity increased by 2,658 animal-unit months, or about 220 cattle, year-long basis. What would it have been necessary to pay for additional range to carry this number? It is very good range that will carry a cow year long to every 30 acres, and this type land east of the Rio Grande is now selling for around \$5 an acre. At 30 acres to the cow and \$5 per acre, it would take \$33,000 to purchase enough to carry 220 cattle. The Prewitts, the Soil Conservation Service, and the Agricultural Adjustment Agency combined, haven't invested anything like this amount in developing the headquarters unit.

Space does not permit going into detail on many other interesting things about this ranch. Rather than omit them, however, here are some additional high lights: After seeing results on the headquarters unit, Prewitt put in water-spreading systems at

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A farmer may tolerate a little of this in some seasons and in some types of woodland, and still not defeat his purpose of growing timber as a crop.

LIVESTOCK IN THE FARM WOODLAND

By JOHN F. PRESTON

For some years foresters of the Soil Conservation Service have consistently and stoutly maintained that livestock must not graze in the woods if a farm woodland enterprise is to be successful. This general premise may be considered the rubric of their faith. Long contact, however, with farmers and with other professional agricultural workers has tended to temper their attitude and caused them to re-examine their position in some detail under the light of the facts of farm economics.

It long has been recognized that grazing of cattle, horses, and sheep in the western coniferous forests, especially in ponderosa pine, when gauged by the available forage, was not inconsistent with forest production and that the result was a favorable factor in fire-prevention. This generalized truth does not necessarily hold for grazing in farm woodlands, chiefly because of the difficulty of controlling the density of stocking. Nevertheless, dual use on farm woodlands in the western coniferous forest types seems to be the premise of farm planners.

In the pinon-juniper type of the southwest, foresters acknowledge that livestock grazing has a much higher priority than forest production. The control of grazing in these types, not its elimination, is

emphasized. In other words, controlled grazing is in line with forestry principles.

In the Coastal Plains of the South, livestock, mostly cattle and hogs, range at will. It is a practice so thoroughly established that it is difficult, if not impossible, to change it. Furthermore, the stocking is usually exceedingly light and there is actually very little appreciable damage to the coniferous forest that predominates. Where these conditions exist on farm woodlands, there is no reason to exclude domestic livestock.

On the fringe of the great eastern forest just before it gives way to the prairie in Oklahoma and Texas is a type of scrub hardwoods (largely farm woodlands) that admittedly produces very little saleable wood. Here the foresters are quite willing to classify such forest types as chiefly valuable for grazing, and therefore, more or less to write them off the books as far as farm forestry is concerned. In the adjacent shortleaf pine stands, the grazing of livestock is a well established practice and, with adjustment of density of stocking to available forage, foresters admit that dual use is practicable.

The progress of the work of the Soil Conservation Service led away from specialization, and hence foresters of early days became more and more identified with general problems of farm conservation as seen through the eyes of farm planners. This experience resulted in a more liberal attitude or perhaps a

Editor's Note.—The author is chief of the Forestry Division, Soil Conservation Service, Washington, D. C.



This is obviously overgrazed—should not be allowed to occur by any farmer who is trying to grow timber as a farm crop.

better appreciation of the importance of livestock to the farm economy. They became more conscious of the fact that on many farms the livelihood of the farm is intimately tied up with the welfare of the livestock and that, in fact, the latter is very often the *sine que non* of farm success.

Farm planners approach the farmer with a sympathetic attitude toward the problem of providing forage for livestock, and with very definite ideas in regard to the effect of grazing on the productivity of the woodland. They attempt to "set up" the farm woodland enterprise alongside the livestock enterprise so that they are complementary rather than antagonistic. Foresters, trained as soil conservationists, agree that the essential principle is to have the farmer recognize the woodland as a farm enterprise and undertake its management so that it contributes most to farm economy. Livestock may be entirely excluded from the woodlands, there may be limited grazing or seasonal grazing at times when it will do the least damage to forest growth, or there may be dual use throughout the year. In some circumstances and in some forest types, which usually include the central and northeastern hardwoods and the planted shelterbelts of the Great Plains, conservationists insist that no compromise with principle is possible. If the farmer must use the woodland as a pasture, the development of a farm woodland enterprise is not possible. However, a compromise, not of principle but of geography, may be possible and is, in fact, often made. The farm con-

servation plan is determined by the farmer, assisted by the conservationist, largely after consideration of two factors: land capability classes and farm economy. The final decision may be that only part of the area now covered with forests will be the basis of a woodland enterprise. If exclusion of livestock is essential to success, a good stout fence to keep it out of this part of the woods will be a part of the plan.

Here are the expressions of policy generally applicable in the regions so far as they are expressed in handbooks or field memoranda or implied in statements of record. They are given from west to east.

Pacific Region.—In a territory so vast and with such widely varying conditions a simple statement of policy, uniformly applicable, is obviously impossible. In a handbook for Northern California, I find this recognition of the damage from grazing in farm woodlands: "Domestic livestock kill reproduction by browsing and trampling and may retard growth by compacting the soil."

Southwestern Region.—In the type of forests in this region, dual use is obviously the rule, rather than the exception.

Northern Great Plains Region.—The general policy is no grazing; again subject to modification locally in some coniferous types. "Grazed farm woodland is poor land use. Grazed woodlands produce neither good pastures nor good woods."

Western Gulf Region.—"The degree of grazing protection required for areas planned for woodland

or wildlife depends upon the plant species desired and the classes of livestock. All woodland and wildlife areas; including existing woodlands, plantations and natural reproduction areas, must be given a degree of grazing control which permits the establishment of reproduction, natural or planted, of the desired species and its continued growth to full usefulness for the purposes intended, and which maintains adequate ground cover for erosion control * * *. These policies apply only to fenced areas. Open range grazing has destroyed potentially high woodland and wildlife values throughout extensive areas. * * * but the only thing this Service can do to control open range grazing is to encourage cooperators to depend upon their own improved pastures and whenever possible fence the woods out of the open range."

Upper Mississippi Region.—No grazing in hardwoods. "Continual intensive grazing by domestic livestock in woodland is of even more damage to a hardwood forest than is an occasional fire."

Southeastern Region.—Coniferous forests predominate. "Provide for protection from damage by grazing. If fencing is necessary and the fence cannot be constructed immediately, the plan should provide for accomplishing this over a period of years consistent with the farmer's ability."

Northeastern Region.—No grazing in any farm woodland.

Actual performance is the best index to present policy. Here are examples from what I have seen, or read in the farm plans. In one case in California, a cooperator in a farm forestry project had built a fence through the middle of a small woodland of young Douglas fir. On one side of the fence, grazing of sheep was allowed, on the opposite side, no grazing. The farmer was to keep records and watch results. That was admittedly an experiment.

In the redwood region, a farm woodland management plan covering a big area of woods that is a part of a livestock farm provides that the cooperator will "protect the forest area from damage by domestic livestock." A variety of forest types are represented on this farm in the areas open to livestock grazing—hardwood, redwood, Douglas fir, chamise, scrub oak, and various combinations of these. Another example from the Sierras is ponderosa pine type—"field 14 will be used for pasture in the event the owner establishes a sheep enterprise. Except for occasional shade trees all the timber should be cut and utilized." It is here recognized that we must either have sheep pasture or woods, but not both. In setting up a woodland enterprise the possible usefulness of grazing as well as the potential damage in is

worthy of study. Grazing can sometimes serve a useful silvicultural purpose. I was shown an excellent example of such use of livestock in Mississippi. On the farm forestry project a farmer took us along a fence line through a hardwood forest. On one side was a thrifty stand of young pine mixed with the hardwoods, on the other side almost pure and largely inferior hardwood. The explanation? Goats grazed where I saw the pine, eating the hardwoods but finding the pine seedlings less palatable. The farmer realized the danger of continued goat grazing and removed the animals in time to prevent their silvicultural operations from backfiring into destruction of all vegetation.

In east Texas, in a mixed hardwood-pine woodland a farm plan provides "fire should be kept out of the woods at all times and no grazing should be permitted." On the other hand, in Arkansas, under like forest conditions, I found cattle grazing in a 200-acre farm woodland apparently doing so little damage that no one suggested that it would be desirable to remove them. In Virginia the farm plan for a farm containing a similar forest type reads, "this area will be protected from fire and grazing." In Irwin County, Ga., a farm plan states, "The shortage of pasture * * * will be overcome by several areas of carpet and other native grasses in the farmer's woodland and on the adjoining range." The restrictions on grazing are getting tighter but the livestock are tolerated under some circumstances.

In North Dakota, in the Turtle Mountains, the forest type is largely poplar or "popple." In one instance only 40 acres in a 160-acre farm woods were fenced from livestock, although the entire 160 acres were included in the woodland management plan. It may be that controlled grazing here will answer best the problem of the farmer who wants to produce both livestock and wood products. In Idaho in the white pine, cedar, Douglas fir, larch and ponderosa pine types, controlled grazing seems to be the accepted practice. In Western Washington the Douglas fir type does not often contain much forage, but the farm planners say "grazing is not recommended" rather than, "grazing is not permitted." In the western hemlock type they say "no grazing." Here is the recommendation on the farm of Stewart Bush, a cooperator in the Cowlitz Farm Forestry project: "The need for additional pasture area is recognized as urgent. However, the slashing of areas which support excellent stands of young second growth fir just as they are becoming merchantable, such as fields 3, 10, and 23, would need to be done at a great sacrifice in the value which could be derived

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RANGE MANAGEMENT CONTRIBUTES TO WAR EFFORT



Good grasses are abundant on this winter range 6 weeks prior to normal growth period, assuring adequate forage for the cattle. The healthy growth of grasses on this range provides an adequate cover to conserve moisture for the production of forage during the ensuing year. Under such conditions, forbs appear seasonally to add further to the grazing value of this range.

By KENNETH FIERO

If the ranges are to make their maximum contribution to the war effort, their management must necessarily be directed to maintaining in thrifty condition a high proportion of desirable forage species.

A rancher in Coke County, Tex., produced more pounds of lamb and wool from 200 sheep per section than was previously obtained from 250 sheep. The 200 ewes, grazed under a system of deferment and rotation, produced a lamb crop averaging 71 pounds, as contrasted to a lamb crop averaging 47 pounds from 250 ewes per section.

On a sheep and cattle ranch, in Presidio County, Tex., heavy stocking with lightweights resulted in a low lamb crop and a reduced total production of livestock products. It also caused a high death toll from "hollow belly," an ailment common on excessively grazed ranges, and started a downward trend in the range condition. The rancher reduced the number of animals by approximately 30 percent and now is being rewarded by higher yields, increased lamb crops (90 percent compared to 65 percent), and higher calf crops. The division of large pastures into several smaller pastures permits seasonal use, which assists in arresting the downward trend in the condition of the range.

These examples emphasize the fact that the amount of feed harvested by livestock is an all-important fac-



Only less desirable grasses remain a month prior to normal growth period. The more desirable grammas have been used excessively on this range, while three-awn, muhly, and burro-grass have held little attraction to the grazing livestock. Under these conditions, the poor grasses are given every opportunity to displace the better grasses and forage production will be impaired each succeeding year unless the downward trend of the range is arrested.

tor in the maintenance of plant vigor. Plants must have adequate leaf surface and rest periods. Maintaining a vigorous growth of palatable plants is assurance that the livestock will receive the essential nutrients for maximum growth.

Destruction of all top growth through excessive grazing is the initial step in range deterioration. Decadence is soon hurried along by the introduction of other factors which make it hard for the better forage plants to live. The invasion of the less desirable plants is an indicator of range decadence.

EDITOR'S NOTE.—The author is range conservationist, Soil Conservation Service, Fort Worth, Tex.

Among the grasses, three awn is probably the most widely distributed of such species, with muhly grass, burro grass, and fluff grass dominating local areas. These species contribute no significant quantity of forage for livestock production, inasmuch as stock seldom grazes them when more desirable plants are available. Invading forbs and shrubby plants, in general, likewise are of little grazing value. Among these are the toxic plants that take large death tolls in livestock.

Replacement of the low quality plants with desirable species will provide better forage and will assist the conservation of soil and moisture. Management practices which permit desirable plants to carry on their essential physiological functions are prerequisites to the restoration and maintenance of desirable forage species and maximum sustained production of livestock.

While the intensity with which the individual species in the plant community are grazed is of utmost importance, the season of use also may have a very significant influence in the maintenance of ranges. The danger of too early spring use is well known. The amount of use in the fall may be equally important. Although it is generally thought that the perennial grasses are immune to damage during their period of dormancy, studies reveal that growth activity is in process throughout the year and that damage may be as extensive during the so-called dormancy stage as during the early stages of seasonal growth.

In the case of blue grama, fall may be a more critical period than spring, due to interference with the translocation of food to the roots and the setting of buds for growth during the ensuing year. This being the case, the importance of fall deferment is greatly magnified on the ranges in good or excellent condition. Such ranges rarely have an appreciable amount of reproduction from seedlings, and the seedlings rarely develop into mature plants. Blue grama tillers readily however; hence, management should be directed to encouraging this process. Ranges in fair or poor condition should have the advantage of longer rest periods to restore the productive capacity of the desirable forage species. In many instances, even moderate grazing should be delayed through the growing season and in the fall until danger of disrupting the physiological function is at a minimum.

Variable factors common to the range country present a difficult problem of adjusting livestock numbers to coincide with annual fluctuations in forage production. A system that appears to be a practical solution to this problem is being employed by a number of ranchers. The plan consists of adjusting the size of the breeding herd to the forage production anticipated during a year of low rainfall and to other

factors which may contribute to below-average production. During years when a surplus of forage is produced, calves may be carried over to yearlings to utilize the forage. The marketing of dry stock and the culling of inferior stock are logical steps in making the initial adjustments.

Deferred grazing, or the delayed use of forage on portions of the range, provides a practicable system of increasing forage production. Buffalo grass will yield as much as 20 percent more forage when deferred from 6 to 8 weeks during the growth period. The additional feed resulting from this simple practice is a significant contribution to the war effort when converted to pounds of livestock and livestock products.

Buffalo grass, and other plants of similar growth habits, such as curly mesquite, respond most favorably to relatively short periods of deferment. Blue grama, side-oats grama, and the bluestems make their greatest contribution of forage when deferment is for a longer period.

Tobosa, three awn, and black grama have peculiarities unlike the plants mentioned previously. These plants are attractive to livestock, for short periods during the year. In mixtures with more palatable plants, these less preferred plants are not fully utilized. When they occur in appreciable quantities they may be isolated for use during the brief periods when they are most succulent. Otherwise, the plants with higher palatabilities may be grazed excessively while the less preferred plants are given opportunity to increase in the plant community.

Requisite to good range management is knowledge of the kind and amount of forage available, the seasonal development of the forage plants, and the time and intensity of harvest to which the plants can be subjected without depreciating the maximum yield of forage for livestock production. These are fundamental considerations in planning the use of the range lands in order that the ranges may yield their maximum sustained production for the war effort.



Undesirable grasses and shrubby plants supply 85 percent of the total forage cover. The displacement of the better grasses has reduced the forage production. The crusting of soil and a scanty cover of vegetation cuts down the effective use of moisture.



Data obtained on these plots and in the laboratory at the soil conservation experiment station, Bethany, Mo., were used to determine what happens to soils under different managements.

REBUILDING ERODED SOIL IS A SLOW PROCESS

By R. E. UHLAND

The rebuilding of severely eroded areas is an integral part of the soil conservation problem. Many soils have already lost a large part of their top soil, and their production has been seriously lowered. Appropriate steps should be taken to check erosion and restore production.

Experimental plots established on the soil conservation experiment stations at Temple, Tex., and Bethany, Mo., show that the productivity of poorly protected top soils is lost very rapidly by erosion. These experiments show, further, that once the humus-charged granular topsoil is removed the exposed subsoil usually absorbs water more slowly, loses more water as run-off, erodes more quickly, and produces poorer crops. Even with the best of management these exposed subsoils regain very slowly their organic matter and their ability to produce crops.

At Bethany, Mo., the organic matter content of the 0.7-inch layer of topsoil was 3.23 percent in 1930. With 13 years of continuous cropping to corn, the soil loss through erosion was 51 tons annually or 4.9 inches. The organic matter of the remaining topsoil decreased to 2.23 percent, representing a decline of 10 tons of organic matter in 13 years. Under a 3-year rotation of corn-wheat-hay, the soil loss was 7.2 tons annually, totaling 0.7 inch for the period. The organic matter remained unchanged at 3.23 percent.

Where alfalfa or grass occupied the land for 13 years, the soil loss for the entire period was less than 0.01 inch. The percent of organic matter for the al-

falfa plot increased to 3.93 percent; and for the grass plot, to 3.61 percent. Thus, under alfalfa the organic matter in the 0-7-inch layer of soil increased 0.70 percent or 7.0 tons per acre; while under grass, the increase was 0.38 percent or 3.8 tons per acre.

A soil-renewal experiment was started at Bethany to see how rapidly the organic matter and the crop yields of the exposed subsoil of the Shelby silt loam might be increased. The cropping systems used, together with the treatments applied and the crop yields secured for the 11-year period 1932-42, are shown in table 1. The corn yields were especially low, because two of the three crops on plots 1, 2, and 3 were near failure because of drought and insects. In the case of plots 4, 5, and 6, one of the four corn crops failed because of drought and insects.

In 1942 corn was grown on all the soil-renewal plots to see how past treatments might be reflected in corn yields. Corn production, together with percent of organic matter and cumulative soil and water losses for the period 1932-42, are shown in table 2.

It will be noted that the corn yield for plot 2, which was the untreated subsoil, was slightly less than 48 percent of the yield of plot 1, the normal untreated topsoil. This was true for the average of the three crops as well as for the 1942 crop. Plot 3 was limed and cropped to the same 4-year rotation as plots 1 and 2 but received 200 pounds of superphosphate per acre on the oats, yielded 83 percent as much as the untreated topsoil for the 3 years and 84 percent for 1942.

Plot 5 was limed, superphosphate was applied before oats, and a 3-year rotation of corn-oats-sweet clover followed, with the sweet clover turned under in the spring before corn. With this treatment, the

EDITOR'S NOTE.—The author is research-operations liaison officer, Soil Conservation Service, Washington, D. C.

corn yield in 1942 amounted to 102.3 percent of the yield from the untreated surface soil cropped to a 4-year rotation. When manure at the rate of 8 tons per acre was applied before turning under the sweet clover for corn the yield was raised to 64.6 bushels or 150.2 percent of the yield for the untreated surface. On plot 7 which was limed and fertilized and seeded to a grass legume mixture which occupied the land for 10 years the corn yield was 44.2 bushels, or 102.3 percent of the yield for the surface soil that was not treated.

The freshly exposed subsoil at Bethany contained 1.71 percent of organic matter in 1930. Where it was clean fallowed for 13 years the average annual run-off measured 8.7 inches and the soil loss 56.5 tons or 5.5 inches for the period. The organic matter during this period decreased to 1.41 percent, a loss of 0.3 percent or 3 tons of organic matter per acre.

Where a 4-year rotation of corn-oats and 2 years of hay was used on plot 2, the loss on the untreated subsoil was 1.2 inches for the period, but the percent of organic matter in the top 7 inches increased to 1.93, a gain of 0.22 percent, or slightly more than 2 tons per acre. By applying lime and fertilizer to the exposed subsoil (plot 7), seeding a grass legume mixture, and allowing all the crop growth to remain on the plot, the soil loss was but 0.007 inch per acre for the 11-year period. The percent of organic matter was raised to 2.16 percent, representing a gain of 0.45 percent or 4.5 tons per acre.

These findings show that under a 4-year rotation (plot 1) on the normal surface soil of the moderately

eroded Shelby silt loam the organic matter was lowered during an 11-year period from 3.02 percent to 2.84 percent. In another experiment, 13 years of continuous cropping of the surface soil to corn decreased the organic matter to the extent of 1 percent, or the equivalent of 10 tons per acre. On an adjacent plot cropped to a 3-year rotation the organic matter was maintained at 3.23 percent for a 13-year period.

If we assume that these rates of change in organic matter on these desurfaced soils will continue, it will require but 66 years of cropping to a 4-year rotation of corn-oats and 2 years of hay to build the organic matter up to the level contained in the topsoil as it was tested in 1930. By liming and fertilizing and seeding to a grass legume mixture (plot 7) and allowing all crop material to fall back on the desurfaced soil, the organic matter equivalent to that contained in the original topsoil could be attained in a little less than 30 years.

Exposed subsoils, however, are usually more difficult to cultivate, allow more run-off, have less plant food, and make less effective the rainfall with which to make a crop. Unless erosion and run-off are controlled, much of the plant food applied as fertilizer may be lost. It should be pointed out that the cultural operations on these soil-renewal plots were carefully performed and the run-off and soil losses were held to a minimum. Under field conditions plowing of severely eroded lands or exposed subsoils average much shallower, and the run-off and soil losses are much greater.

Obviously, the rates of change in organic matter

Table 1.—Crop yields on soil renewal plots at Bethany, Mo., for 11-year period 1932-42

Plot No.	Cropping system	Treatment	Crop yield per acre		
			Corn	Oats	Hay
			<i>Bushels</i>	<i>Bushels</i>	<i>Tons</i>
1	C-O-Cl. & T-Cl. & T.	None	14.6	16.3	1.03
2	C-O-Cl. & T-Cl. & T.	None	7.5	3.9	.46
3	C-O-Cl. & T-Cl. & T.	L+P	12.1	16.6	.95
4	C-O-Cl. & T.	L+P	17.4	20.6	.80
5	C-O-Sweet Clover	L+P	22.9	23.5	S. Cl. under
6	C-O-Sweet Clover	L+P+M	29.1	28.0	S. Cl. under
7	Grass and Legume mixed	L+P	² Only 1 crop	No harvest	No harvest

¹ All plots desurfaced (exposed subsoil) except Number 1, moderately eroded surface soil.

² Plot 7 remained in grass and legume mixture for period 1932-41, when it was spaded and put in corn along with all the other plots.

C—corn; Cl—clover; L—lime; O—oats; P—phosphate; T—timothy; M—manure—8 tons/acre before corn; S. C—sweet clover.

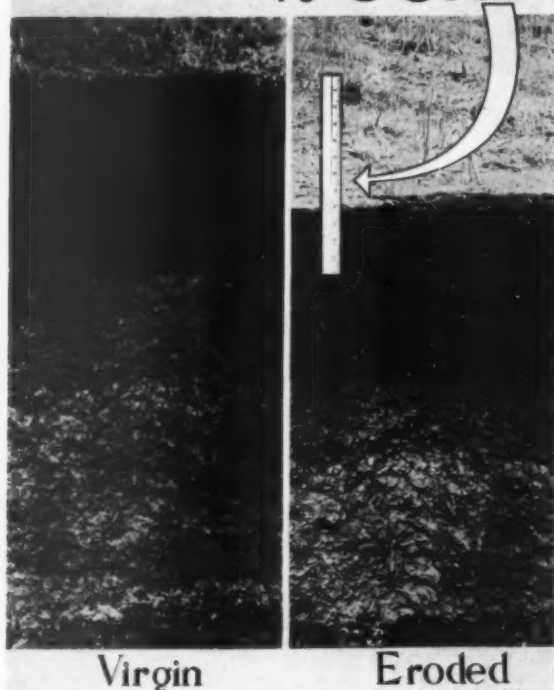
Table 2.—Data on soil renewal plots at Bethany, Mo. (See Table 1 for cropping systems and soil treatments)

Plot No.	Corn yield 1942	Organic matter 1943	Soil loss 1932-42	Water loss 1932-42 ¹	Plot No.	Corn yield 1942	Organic matter 1943	Soil loss 1932-42	Water loss 1932-42 ¹
	<i>Bushels/acre</i>	<i>Percent</i>	<i>Inches</i>	<i>Inches</i>		<i>Bushels/acre</i>	<i>Percent</i>	<i>Inches</i>	<i>Inches</i>
1	43	2.84	0.83	42.9	5	44.0	2.00	.72	33.0
2	20.5	1.93	1.22	48.4	6	64.6	2.26	.62	34.1
3	34.6	1.96	.53	29.7	7	44.2	2.16	.007	12.1
4	32.2	1.89	.76	39.6					

¹ The total rainfall for the period 1932-42 was 134.5 inches, an average of 29.5 inches per year.

² The normal surface soil in 1932 contained 3.02 percent organic matter and the freshly exposed subsoil contained 1.71 percent organic matter.

PRODUCTIVE SOIL $\frac{2}{3}$ GONE



recorded for the desurfaced plots are greater than would occur under normal field conditions.

Most investigators have found that cultivated soils accumulate organic matter at a much slower rate as the organic matter increases. In other words, we would expect it to take a great deal more time and be more difficult to increase the organic content of a soil at a given location from 2.5 percent to 3.5 percent than to increase it from 1.5 percent to 2.5 percent. It might be noted also that (plot 1) the normal surface soil contained 3.02 percent organic matter in 1932 but without treatment declined to 2.84 percent, a loss of 0.18 percent, or 1.8 tons per acre in 11 years. These observations would indicate that the accumulation of organic matter in these soil-renewal plots will become increasingly slower, and the time required to bring the organic matter above 3 percent (that found in the topsoil in 1932) will be greater than indicated above. There is a question as to whether it can ever be raised to this point while cropped to cultivated crops. If left in grass and legumes, as in plot 7, it is possible that in time the organic matter would be restored.

At Temple, after 10 years of cropping to cane, Sudan, and oats and the growing and turning under of a green manure crop each year on the Marly C horizon of the Austin clay, the organic matter was 1.37 percent. Where grass occupied the untreated subsoil for the entire period, the organic matter had increased to 1.60 percent. The organic content of the originally exposed subsoil is not known and we cannot, therefore, tell what change occurred on the cropped plot. If, however, we assume that the organic matter was evenly maintained on the cropped plot, it was increased the equivalent of 0.23 percent under grass. This represents a gain of 2.3 tons of organic matter in 10 years.

The original Austin topsoil contained 2.8 percent organic matter, 1.43 percent more than the exposed subsoil. At this rate of increase it would require a little more than 62 years of grass to bring the organic matter of the subsoil up to that contained in the topsoil. This Marly subsoil consists of about 68 to 75 percent calcium carbonate, and the results show that these soils do not respond sufficiently to commercial fertilizers to pay for the extra cost. Good response, however, is obtained from legumes, green manure crops, and barnyard manure. Legumes commonly used for soil building do not, however, do well on this soil because of root rot, and manure is scarce. The building of organic matter and nitrogen in these exposed subsoils is, therefore, a very slow process.

At Temple the corn yield for 1943 for the non-desurfaced Austin clay was 27.6 bushels per acre, while that for the desurfaced soil, representing the Marly C horizon, was but 16.4 bushels. Thus, after this desurfaced plot had been cropped to row crops for the period 1932-43 with a green manure crop that was turned under each year, the corn yield was but 59.4 percent as great as from the nondesurfaced plot where no green manure crops were grown or turned under.

Color tests were made of the soils from a number of the plots at both Bethany and Temple. It was found that there were some changes in color values; where the organic matter had increased appreciably the color was darker. This was not necessarily always true. The color value for the freshly exposed subsoil at Temple was 7.0, while that for the exposed subsoil on which grass had been growing for 10 years was 6.8. The topsoil of the Austin clay showed a color value of 5.5. It should be added that the higher the number, the lighter the color of the soil.

After 13 years of alfalfa at Bethany, the color value was 3.4 and the percent of organic matter was 3.93, compared with a color value of 3.2 and organic matter content of 3.61 percent after 13 years of grass.

The desurfaced soil cropped to a 4-year rotation for 12 years without treatment had a color value of 4.2, with 1.93 percent organic matter. Where a grass and legume mixture occupied the desurfaced soil for 12 years, the color value was 4.1, with 2.16 percent organic matter. The hue and the Chromatic values changed very slightly for the soils at both Bethany and Temple.

The data from these two widely separated locations show that the organic matter of badly eroded soils was increased and the yields improved, but the rate of increase was very slow and may be expected to be slower as the level of organic matter increases. In order to increase the organic matter appreciably in badly eroded soils, a cropping system must be used which controls erosion and a large portion of the vegetative growth must also be returned to the soil. By adding barnyard manure, along with fertilizer and lime, the soil was improved more rapidly than without treatment. Observations showed that crop production on the exposed subsoil plots, as well as on severely eroded plots or fields, was affected more seriously by dry weather than was the normal surface soil. The findings indicate that in order to increase appreciably the organic matter in badly eroded soils it is necessary to supply needed fertilizers and maintain them in noncultivated crops most of the time.

RESULTS "ASTOUNDING"

On March 22 Chairman Tarver, of the Subcommittee on Agricultural Appropriations, made the following statement in Committee of the Whole:

"The Soil Conservation Service, in my judgment, is performing a more useful service for agriculture than any other organization of the Department of Agriculture.

"I have had the opportunity to examine its work in connection with soil conservation districts set up in my own State, to which, as to other districts throughout the country, it furnishes technical assistance and assistance in the making of farm plans and otherwise. The result of its work, to one who will take the trouble to examine it, is astounding. It has contributed not only to the restoration of the soil where it has been depleted, but it has contributed, in substantial ways, to the material prosperity of the farmers who have undertaken to cooperate with the Soil Conservation Service in this work, and I feel amply justified in the statement I made a few moments ago to the effect that the Soil Conservation Service is performing a work of more benefit to agriculture than is any other organization in the Department of Agriculture."

(Continued from page 273)

from these same areas by practicing forestry until they are ready for clear cutting. It is believed that additional pasture areas can be supplied from areas which are ready for clear cutting by seeding immediately after the burn and grazing during the period required for the area to reseed to trees."

In Ohio and Michigan in the maple-oak woods and generally throughout the hardwood forests of the east, "fires and livestock must be kept out of the woods at all times." For an Indiana farm woods (hardwoods), "all grazing must be prohibited and fires prevented if a productive woodland is to be the result." Yet sometimes some concessions have to be made to livestock even in the hardwood and the hardwood-coniferous types. For example, one farm plan prescribing management rules for a 60-acre hardwood-pine woodland contains this statement: "To achieve these results, the owner must continue to protect the woodland from fire, and must never let more cattle range the woods than he is allowing at the present time."

In some cases controlled grazing may be the best farm practice even though some damage to the woods is recognized. The damage done by grazing animals are matters of intensity and season. We should not be too dogmatic. It is a farm problem that must be solved for each farm on consideration of the type of forest, kind of domestic animals, and intensity and season of grazing.

In view of the tremendously varying conditions throughout the United States, the difficulty of defining a national policy is apparent. Here is the statement proposed for insertion in the Soil Conservation Service Manual:

The grazing of domestic animals in woodlands, with the exception of regulated open range grazing in some coniferous forests, is recognized as injurious to timber growth, and therefore the efforts of the Soil Conservation Service will be directed toward preventing that damage. Ranging of hogs in longleaf pine forests and in shelter-belts and windbreaks in the Great Plains is recognized as very injurious, but in other types moderate use by hogs may not be objectionable. With the above exceptions, exclusion of domestic animals from the woodlands is the safest rule and unless accomplished, the volume of forest crops will certainly be seriously reduced.

Foresters are neither weakening their attitude nor making great sacrifices in the essential rules of forest practice. Rather, they are becoming more tolerant due to a better appreciation of the reality of the facts of farm economy. Farm forestry problems cannot be solved independently of other farm enterprises. Good farm forestry consists of those practices in the woodlands which in the long run contribute most to farm economy.

MAKING A BURNED RANGE WORK FOR VICTORY



By August 1941 sheet and gully erosion were taking a heavy toll of soil from the burned range.

By IRVIN D. NICHOLAS and RULON C. BERGESON

Each year many thousands of acres of rangeland in the semiarid sagebrush and grass country of south-central Idaho are accidentally burned. Forage capable of feeding thousands of livestock is destroyed, sometimes permanently. The immediate loss to the war effort is in the form of meat products and wool which the animals normally grazing on these rangelands would produce. This story tells how a large tract of range, after the vegetation had been completely wiped out by a destructive fire, was restored to productive use.

On June 19, 1940, the hottest day ever recorded in Boise, a tract of about 7,500 acres of south-central Idaho semiarid rangeland was blasted by a roaring and explosive fire that started from an undetermined origin near the railroad water-stop of Orchard, some 20 miles southeast of Boise, in the Mayfield Soil Conservation District.

All of the sagebrush and virtually all of the grasses were destroyed by the intense heat of the fire. All seed and the entire surface organic matter were consumed. Rodents, insects, worms, and probably even bacterial life in the surface soil ceased to exist over the entire burned area. The blackened and

seared range lay inert and lifeless for many months afterward.

These barren grazing lands, which prior to the fire had been covered by a mantle of sagebrush with a sparse understory of grasses and weeds, soon were subjected to serious soil drifting. Often during the fall of 1940 and the spring of 1941 the atmosphere was so heavily laden with dust that motorists traveling U. S. Highway No. 30, which passes along the northern boundary of the burn, were forced to turn on their lights, even on bright, sunny days. During late fall and winter rains caused heavy sheet and rill erosion over nearly the entire area, in spite of the fact that it is comparatively flat.

In the fall of 1941 the area was still bare of vegetation. Investigations revealed certain climatic and other factors which tended to make successful reseeding difficult: (1) The annual rainfall averages about 10 inches, with only 20 percent falling during the growing period; (2) no effective rainfall may be expected during July, August, and September; (3) the soil for the most part is Chilcott silt loam, a true desert type, highly calcareous, with caliche lime formations near the surface which render the soil impervious to the deep penetration of moisture; (4) normally heavy spring winds contribute to the droughtiness of the surface soil at seeding depth, even though the soil 2 or 3 inches below the surface

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may contain sufficient moisture for plant growth; (5) the presence of rodent colonies in the nearby unburned area would necessitate carrying on a rodent control program around the boundaries of the burn to prevent damage to new seedlings; and (6) even though the burned area in its virgin state had supported a stand of nutritious bunchgrasses and browse, these had disappeared because of previous heavy grazing use and the fire, except for a few isolated areas that contained only small remnants of the original cover.

Though these conditions were recognized as difficult for the survival of grass seedlings, even in the most favorable years and with the best planting methods, seeding of the area to grasses seemed to be the only feasible means of hastening recovery of forage production. Accordingly, the supervisors of the Mayfield Soil Conservation District and Carl E. Nicholson, a Mayfield district rancher who runs approximately 10,000 head of sheep and who has used the area for many years, decided to initiate a seeding program. With the assistance of Soil Conservation Service technicians, they agreed upon a plan for seeding about 3,000 acres, of which 1,500 were to be planted in the fall of 1941. Equipment consisted of three 10-foot drills with double disks, fluted feed and 6-inch spacings, which were pulled as a gang behind a 40 horsepower crawler-type tractor. The drilling operations were started October 24, 1941. Because of bad weather, breakage, and other interruptions, only 1,300 acres were seeded by December 3, 1941, when freezing weather occurred and drilling was stopped.

The seed mixture consisted of 2½ pounds of crested wheatgrass, 2½ pounds of bulbous bluegrass, and 1 pound of biennial sweetclover per acre. Plants of the earlier seeding began to come up before the last of the drilling was finished. Winter rye was seeded in half of one drill, forming a 5-foot strip as a wind erosion control measure.

The results of the seeding in the spring of 1942 were exceptionally good. The rows of tiny new forage plants looked like a wheat field in its early lush growth. It remained to be seen, however, what the plant survival and plant vigor would be after the new plants were subjected to summer heat, drying winds, and rodents. No seeding of grass on desert rangelands in southern Idaho had been undertaken before on so large a scale. The significance of a successful seeding was recognized by everyone, because of the magnitude of the range area that is burned each year, the number of people affected more or less directly by this destructive orchard fire, and

the increased forage that such seedings, if successful, could produce for use by livestock.

The area was not grazed during 1942. This was to allow the new seedling grass plants to become firmly established.

The seeded area was first grazed in the spring of 1943, from April 15 to April 30, by 850 ewes and 1,250 lambs. Mr. Nicholson estimated there was five times as much feed on the planted area as it had ever produced before. When his Basque shepherd was asked, "How good is the grass?" he answered:

"Good, good grass; sheep they spread out, fill up, lay down. Have trouble—sheep he no want to go back into brush." (The "brush" referred to is the surrounding unburned sagebrush.)

On an actual use basis for the first year it was grazed, the area furnished 1 animal unit month of grazing for each 6 acres. This compares with 60 acres of burned range and 12 acres of the adjacent unburned sagebrush range for each animal unit month. At the end of the first year, the seeding had reached only about one-half of the eventual grazing capacity expected when the seedling grasses have fully developed.

The natural reestablishment of a vegetal cover on the *unseeded* portion of the burn has been exceedingly slow. It is estimated that in 10 years recovery may be sufficient to permit 1 animal unit month of grazing for each 20 acres.

Does seeding pay? That the seeding was profitable is borne out by a summary of the cost and conservatively estimated returns. Total cost of the seeding operation, including seed, rodent control, fuel, labor, and machinery depreciation, was \$0.89 per acre. Incidentally, this was offset by AAA payments to Mr. Nicholson of \$0.825 per acre for range improvement and rodent control.

The comparative values of the seeded and the unseeded areas of burned range have been estimated to be as follows:

Item of annual cost	Unseeded (per acre per year)	Seeded (per acre per year) ²
Taxes.....	\$0.05	\$0.05
Interest on investment 4 percent on \$2.....	.08	.08
Interest on seeding costs \$0.89.....		.03
Annual cost per acre per year.....	.13	.16
Estimated average annual value of available grazing ¹01	.20
Annual returns.....	(loss) .12	(gain) .04

¹ Value is based on \$0.60 per animal unit month, customarily used by farmers in the area in normal times. Wartime values would be much higher.

² Beginning with second year of grazing.

The unseeded, burned rangeland is a distinct liability. It will cost the rancher \$1.20 per acre to own

it for 10 years, while the seeded range is a very tangible asset. Although there would be a loss of \$0.03 per acre the first year of grazing due to the necessity of protecting the new growth from full use, there would be a gain of \$0.04 per acre during each of the succeeding 9 years, and a return of \$0.30 per acre during the 10-year period of rehabilitation.

It is conservatively estimated that at the end of 10 years, the seeded portion of the burn, if not improperly grazed, will show an average grazing capacity of 2½ to 3 acres per animal unit month. On a 2½ acre basis, a gross return of \$0.24 per acre, with a cost of \$0.16 per acre, would be realized. This would leave an annual profit of \$0.08 per acre.

Range management practices that give protection while the stand is being established, and which provide for moderate grazing thereafter, must be a part of any successful reseeding program. Control of rabbits and other rodents also must be included in the program of range reclamation where such animals are numerous enough to endanger new seedlings.

Whether the newly seeded stands will retain their vigor of growth under grazing, or decline under the severe growing conditions that typify a semiarid climate, remains to be seen.

The results obtained to date, however, indicate that establishment of forage grasses by seeding burned areas in the intermountain semiarid rangelands under conditions similar to those existing on the burned area described here is both feasible and practicable.

RANGE CONSERVATION PAYS DIVIDENDS

(Continued from page 270)

three other places on his range. Forty of these irrigated acres produced 480 sacks of beans, which helped keep sheep herders and cowhands in "chuck."

Twenty-five head of fattened and slaughtered hogs meant lard and bacon for the same purpose. The 8 acres of garden kept the ranch in fresh vegetables all summer, and the cellar will store "root" crops for winter use. In cooperation with the New Mexico Game Department, elk and wild turkey were released on the uppermost irrigated area. The reservoir has been stocked with bass and bream. No one encouraged the Prewitts to do these things. They are progressive ranchers and conservationists in their own right.

There are many ranchers in the West who are not taking full advantage of opportunities to improve their present holdings. With no open range or new frontiers to move to, and with ranches for sale at high prices, it would pay to investigate the possibility of spreading floodwaters on bottom lands. While the practice involves a number of considerations, there are two of primary importance: (1) Assurance with respect to water rights under State law and (2) appreciation of the fact that water spreading is like any other type of irrigation. It isn't self-operating—it requires careful operation and maintenance.



One-half of every third drill row was planted to rye. This puts up a barrier against the wind, encourages retention of snow moisture, affords winter protection for new plants. This is how the seeded portions looked by August 1942.



Small ditches have produced high yields of muskrats.

FURS FROM FARM LANDS

By PHILIP F. ALLAN

Part II

ARTIFICIAL DENS FOR FUR BEARERS

On any kind of land there may be so few natural dens that artificial ones must be provided if the desired animals are to be encouraged. These should be well scattered and preferably not more than one-fourth mile from water. They should be put in places where they will not interfere with other activities or be a fire hazard, as, for example, brush piled near public roads. If they are farther away from water they are usually little used by the common fur bearers although they may be used by cottontails.

Relatively permanent suitable dens may be provided as a part of ordinary farm or ranch operations by piling unwanted materials, such as rocks, stumps, or brush, in otherwise unused parts of the farm. The profit from opossums, skunks, raccoons, and minks often will repay the trouble of hauling to a suitable site.

Opossums and raccoons readily use nest boxes built on the style of bird houses. These are made of slabs, rough boards, hollow logs, or small kegs, and are securely fastened well up in trees along streams or hedges. An inside dimension of 12 by 12 by 36 inches is desirable, and a 5- to 8-inch entrance hole is needed. A tight-fitting roof completes the nest box.

Artificial underground dens of old culvert pipe or tile have proved attractive to striped and spotted skunks, weasels, minks, opossums, raccoons, and cot-

tontails. The pipes or tiles are buried at least 10 inches deep in a well-drained site, or so place that they provide dry dens. When tiles are used, an old milk can buried at the end of the excavation serves as a nesting place. Large rocks placed at the entrance so as to leave a 6-inch hole will prevent dogs from digging around the den.

In the long run, improvement of the habitat is more satisfactory and less expensive than constructing artificial dens, but the farmer or farm boy with plenty of time and materials will undoubtedly find it interesting and worth while to construct such dens.

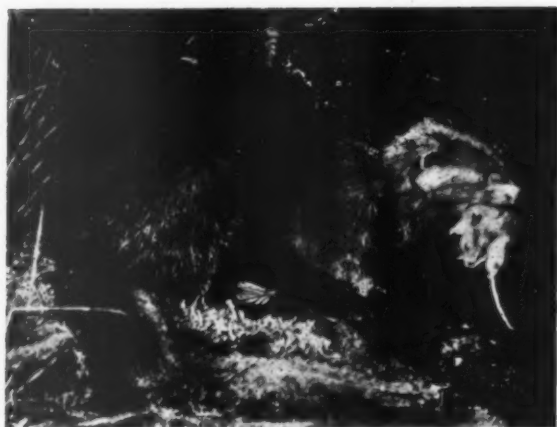
PROTECTING BURROWING ANIMALS

Burrowing animals are undesirable in crop fields and meadows or other places, where they seriously compete with or damage farm and ranch crops. On wildlife lands and woodlands and in many pastures they do little or no harm. Their control on these lands is seldom economical, and their protection means more dens for fur bearers. A chain of events usually provides a den for a large animal—a fox, for example. The burrow of a shrew, perhaps following that of an insect, may be enlarged by a cottontail. A woodchuck, then, may adapt it for its own purposes, and later a skunk or opossum. At last a fox reworks the burrow for his own home. Woodpeckers and squirrels may well be responsible for many raccoon dens.

HOW TO HARVEST FUR BEARERS SAFELY

The principal problem of managing fur bearers is that of taking the greatest number without damage to the breeding population. In order to do this it is necessary to have some idea as to the numbers pres-

EDITOR'S NOTE.—The author is senior biologist, Biology Division, Soil Conservation Service, Washington, D. C.



A mink.

ent, but since accurate census methods are relatively unknown even to wildlife managers, the use of general indicators must suffice. Trappers should watch closely the abundance of fur bearers before the trapping season and should notice changes in the habitats. Droughts or floods destroy many animals, even though, by concentrating them in limited areas, they may make the animals seem abundant.

Muskrat

The muskrat responds to good management of marshes, ponds, streams, and ditches more readily than do any of the other fur bearers. It also furnishes us with many clues to its abundance.

Houses and dens.—The number of "active" houses—that is, those which show signs of internal use—may serve as a rough indicator of muskrat abundance. Such records as are available show an average of more than 1 muskrat per house—for practical purposes, 2; in good years, 5 or more per house. Roughly, the more houses within a given area the greater the yield per house. Under conditions of low water and dense vegetation, however, a small number of muskrats may build a great many houses and, hence, mislead the trapper into thinking muskrats are abundant. A good habitat sometimes has as many as 10 houses per acre, but the unimproved coastal marshes average about 3.

Where conditions are suitable, muskrats dig burrows, which they seem to prefer to houses. The trapper may find burrows by locating the under-water runways leading into them. Burrows appear to harbor larger numbers of muskrats than do houses. The presence of droppings in the vicinity of burrows indicates their occupancy. Under ordinary conditions about three muskrats per burrow may safely be taken.

Condition of food plants.—When muskrats become

abundant they may graze the food plants heavily for 30 to 40 feet about their houses or burrows. This is generally considered an indication of the need to trap many muskrats, particularly if the grazed areas about several houses or dens meet.

Evidence of fighting.—Fighting between muskrats often results from high population. This may be due to some especially favorable condition in an otherwise normal habitat. When this is true, they may be trapped heavily. On the other hand, it may be that an unfavorable habitat condition has concentrated all the muskrats in a small area, and it may be inadvisable to trap at all.

Population changes.—Muskrat numbers are said to increase and decrease periodically, with peaks every 9 to 11 years. Whether the changes are periodic or not, there are changes during wet and dry years. Observation over a number of years may indicate increasing populations, which may then be heavily trapped. Drought or floods may reduce their numbers or may cause the muskrats to move overland. If the movements occur during the trapping season the animals may as well be trapped, for similar habitats are likely to be fully occupied or in a flooded or droughty condition, and mortality of migrating muskrats is usually high.

Safe harvests.—Muskrats usually produce one to four litters a year, depending on locality and other factors. In the North litters are fewer than in the South. Mortality of the young is high, but generally enough survive to permit profitable harvests. In years of small numbers 60 to 70 per cent of the entire population at the time of trapping probably can safely be taken. In good years it is safe to take 70 to 80 percent.

The proportion of males and females in the catch is an indicator of when to terminate spring trapping. When females outnumber males in the daily catch for several consecutive days toward the end of the season, experienced trappers believe that enough muskrats have been taken. Some stop trapping at the point when females constitute one-third of the total season's catch. As an all-around rule of thumb, traps should be pulled when the catch begins to fall off, unless the decline is due only to a few days of unfavorable weather.

Opossum

The improvement of habitats for the opossum will largely be a byproduct of improvements for other fur bearers or of the management of stream banks, hedges, and woodlands.

Dens.—Watching for dens throughout the year,

or tracking the animals to them when possible, may give a clue to abundance of burrows, rock crevices, culverts, and hollow trees which serve as den sites for opossums. In excellent habitat, one out of every four suitable dens may be occupied by opossums.

Safe harvests.—From the little evidence available it is apparently safe to take one-half to three-fourths of the opossums annually. Not more than one-half is recommended for northern areas. A single report of sustained yield in Mississippi indicated that a 66-per cent harvest did not adversely affect the breeding population.

Skunk

As with most farm fur bearers, skunks reach their maximum abundance near streams, ponds, sloughs, and ditches, although they are not confined to such areas.

Dens.—Some studies of skunk dens revealed that about 1 out of every 5 dens is occupied. In one study, one-third of all known dens had skunk occupants. Winter populations of occupied dens average 2 skunks, but it is not unusual for a den to contain 10 to 12. A harmful practice in many localities is the opening of dens and killing the skunks inside. Usually in dens containing many skunks, females predominate. The destruction of these may depopulate a large area for a year or more; moreover, the den, as a result of digging, will be uninhabitable.

Population changes.—Skunk populations fluctuate greatly, although there is little evidence of regularity. According to trapping records, they decline or increase in adjoining States at the same time. For example, from 1935 to 1938 skunks were apparently abundant in Michigan, Illinois, Wisconsin, Minnesota, and Iowa but decreased throughout those States in 1939 and 1940. Trapping should be reduced during times of low numbers.

Raccoon

Raccoons are usually most numerous within one-fourth to one-half mile of a watercourse, lake, swamp, or marsh, although occasionally they may be abundant in dry woods.

Dens.—A single family of raccoons may use several dens, some of which may be tree dens and others rock crevices, culverts, or other ground dens. In good habitat an average population is about two 'coons per occupied tree den.

Safe harvests.—An average of slightly more than one raccoon per den in good habitat apparently can be safely taken. At the western and northern limits of raccoon range one-half the fall population can be trapped, elsewhere it is safe to take two-thirds.

Mink

Considerable care is required with mink, for, of all the fur bearers, they are the easiest to overtrap.

Mink show a marked preference for brushy streams, although they are abundant in marshy areas. In one study, four times as many mink were found in brushy areas as in marshy ones. They seldom wander more than 30 feet from the stream but are believed to travel long distances along watercourses.

Dens.—A single mink uses a number of dens within its territory.

Safe harvests.—Perhaps one-half of the mink can be safely harvested. A sustained-yield record, however, showed two-thirds. If the number of occupied dens is known, a safe rule of thumb for harvest may be one mink per three or four dens.

DAMAGE FROM FUR BEARERS

The farm fur bearers sometimes damage poultry, crops, or earth structures. On the other hand, skunks are valued by many farmers for their destruction of white grubs, weevils, and other insects, as well as rodents. Minks and raccoons likewise eat many of these pests. Killing the animal that is doing the damage often is all that is necessary.

Good care of poultry, including housing in a well-built poultry house, not only prevents harm from skunks, opossums, raccoons, and minks but also from rats. Whenever it is practical to do so, poultry houses and yards should be located at some distance,



A raccoon.

preferably at least an eighth of a mile, from bodies of water. Lanes of cover, such as tall grass, weeds, or brush, should not join poultry houses and yards with stream banks or other fur-bearer habitat. If shade is desired for poultry, trees rather than shrubs should be used.

Removal by shooting or trapping is the only effective way of preventing muskrats and raccoons from damaging corn. Muskrat damage to corn ordinarily is greatest within 50 feet of water. Since a muskrat pelt generally sells for as much as a bushel of corn, the damage need not represent a total loss. A border of persimmon trees around an orchard might minimize damage to fruit by opossums.

A solid core or a layer of sand or gravel a foot deep on the face of an earth structure will prevent most damage from burrowing muskrats. Wire netting and piling are sometimes effective.

OTHER FUR BEARERS

Although weasel fur is sixth in volume production of wild furs it is unlikely that many farmers would make any effort to increase it. The pelts are generally low in value. Brush, stump, and stone piles near grassy cover are attractive to weasels. In orchard, meadow, or crop field, weasels may be distinctly beneficial because they feed on rodents.

Red, gray, and swift fox furs are collectively seventh in volume production of wild furs. Foxes, like weasels, often are unwanted on farms. The gray and swift foxes bring lower prices than the red. The foxes usually hold their own unless heavily trapped or hunted.

Generally farmers and ranchers cannot legally take beaver, although the beaver is increasing on agricultural land in many places. To the landowner, the greatest value of the beaver comes from its water-holding dams. They may be useful in creating conditions suitable for muskrats and minks. Beaver should not be stocked near irrigated land or orchards.

Badger pelts are always in considerable demand; but aside from protection, no management measures directed toward the increase of badgers are known. Badgers are one of the principal enemies of mice and ground squirrels.

In areas where sheep and poultry are not raised extensively the coyote is valued locally as a fur bearer, and its destruction by methods which prevent utilization of its pelt rob us of this source of fur. At present the pelts bring high enough price to warrant careful consideration of the methods used in killing coyotes.

Squirrel pelts usually are a byproduct of hunting for sport and food, but many of them are sold for fur. The greatest single contribution that can be

made to the management of squirrels is protecting woodlands from livestock.

The pelts of wood chucks, whistlers, and rock chucks are of little value, but the animals themselves are generally considered valuable to other fur bearers because their dens are used to a large extent by skunks, opossums, foxes, weasels, and badgers—and the woodchucks themselves are eaten by several of these.

Cottontails are generally considered game rather than fur-bearing animals, although some pelts are taken. As providers of dens for skunks, cottontails are important. Their most important value to fur bearers, however, is as food. At present the uses for jack rabbits are few, and no one is likely to try to increase their number despite the fact that pelts have brought 18 to 35 cents recently. There is a considerable demand for the carcasses to provide food for farm animals and dogs.

HANDLING AND CARE OF PELTS

Any reputable local fur buyer or raw-fur purchasing company will supply information on how to skin fur bearers and handle the pelts so as to bring highest returns. Such information is available through many State conservation departments or State colleges. Well-prepared pelts mean more money. Since a large proportion of wild-produced furs are average in size and quality, one should not be misled by price quotations on "extra large" or "extra fine" skins. Measured unstretched from the nose to the base of the tail (muskrat, opossum) or end of tail bone (skunk, raccoon, mink), pelts which are within an inch or two of the following measurements can be considered of average size: Muskrat, 11½ inches; opossum, 18 inches; spotted skunk, 20 inches; striped skunk, 24 inches; raccoon, 30 inches; and mink, 24 inches.

Furs vary in price from year to year and from place to place. Northern and eastern furs generally sell for more than southern and western ones. During the period 1900-1935 the average prices per pelt were as follows: Muskrat, 97 cents; opossum 24 cents; striped skunk, \$1.38; spotted skunk, 45 cents; raccoon, \$1.75; mink, \$2.26. During the war period 1914-18 furs brought very high prices, and during the present war they are again rising.

Merchants of Conway, S. C., have shown their interest in the work of the new Horry Soil Conservation District by purchasing 5 books on soil conservation and having 5,500 handbills on pastures printed and distributed through the district, Ernest Carnes, South Carolina state conservationist, reports.

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DETROIT



Secretary Claude R. Wickard and Lorenzo R. Patino meet to discuss Mexico's agricultural needs. Mr. Patino is Chief of the Department of Conservation in our neighbor Republic to the south. His department is a bureau of the National Irrigation Commission.

Soil conservation work is being projected in five states in Central Mexico. Surveys and practices adhere closely to those which are proving so successful in the United States.

Mr. Patino, who arrived in this country in March, will be with the Soil Conservation Service until July 1 studying the war-motivated conservation-production work in the South.

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